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Beech Utilization Series No. 8

Beech For Flooring

by
E. A. Lefkoff

Northeastern Technical Committee
On the Utilization Of Beech

in cooperation with

Northeastern Forest Experiment Station
Forest Service, U.S. Dept. of Agriculture

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FOREWORD

The wood of the American beech tree (Fagus grandifolia Ehrh.) is well suited for a large number of uses, and it is rather widely used by manufacturers. Yet the amount used is not in proportion to the amount that grows in our northeastern forests. The utilization of beech--both in the woods and in the factory--has been recognized as a problem.

One reason for this is in the nature of the wood: it has a reputation for being difficult to season. Another is that many of the beech trees in our forests are of poor quality. And there are some plain prejudices against beech.

Research is finding ways to utilize beech as efficiently as any of the other comparable hardwoods can be handled. Considerable information about beech has been gathered. Yet most of this information is available only in fragmentary form in scattered technical reports. Some of it has never been published.

To study the problems of putting beech to the uses it deserves, and to promote the better management of the forests in which it grows, a Northeastern Technical Committee on the Utilization of Beech was organized in 1949. This committee, which includes representatives of Federal and State forestry agencies, universities, and state experiment stations, decided to assemble and publish the available information about the utilization of American beech.

As its part of this cooperative project, the Northeastern Forest Experiment Station has undertaken to edit, publish, and distribute the series of reports that will contain this information.

The subjects of these reports will be as follows:

* Physical and mechanical properties of American beech.

(CONTINUED ON INSIDE OF BACK COVER)

BEECH FOR FLOORING

by

E. A. Leftof

*Formerly Chief, Division of Forest Management
Pennsylvania Department of Forests and Waters*

INTRODUCTION

FOR USE AS FLOORING, beech is a versatile wood. Its color and attractiveness give it entry to the finest homes. Its strength and durability adapt it to use in industrial plants and public buildings where it is subjected to the severest wear.

In the sum total of its qualities, beech is as suitable for flooring as any of the other woods that are commonly used for flooring, such as white oak, red oak, hard maple, and yellow birch.

Yet comparatively little beech flooring is manufactured. The two major associations of flooring manufacturers, the National Oak Flooring Manufacturers' Association and the Maple Flooring Manufacturers' Association, estimate that beech flooring constitutes less than 3 percent of the output of their members.

There are probably two main reasons for this: (1) Consumer prejudices against beech, which stem largely from ignorance of its qualities; and (2) manufacturing difficulties, especially in seasoning.

This paper is written primarily for the flooring manufacturer, to point out the qualities of beech that make

it suitable for flooring, and to indicate ways in which some of the manufacturing difficulties can be overcome.

THE DESIRED QUALITIES

To be acceptable for flooring, a wood must fill the requirements set up by the building experts. Among the most important of these are (1) structural qualities, (2) resistance to wear, (3) comfort, (4) attractiveness, and (5) capacity for being restored to original condition. Beech rates well in all these requirements.

Structural Characteristics

Beech wood is hard, strong, heavy, and close-grained. It is stiff; and its resistance to shock is high. These qualities of beech, as compared with other hardwoods commonly used for flooring, are described in detail in another publication in this series (4).¹

Shrinkage is highly important. In radial shrinkage, beech compares very well with other flooring woods. But in tangential shrinkage, it is at a slight disadvantage (table 1).

If flooring shrinks excessively, gaps may appear between boards. This may happen in houses in the winter, when heating dries out the wood. And if dry flooring picks up moisture, the swelling may cause bulges in a floor.

This disadvantage can be practically overcome by manufacturing unselected beech into strip flooring no more than $2\frac{1}{2}$ inches wide (the most commonly used size), and by careful handling and laying of the flooring (6).

Plank flooring should probably be made only from carefully selected pieces of quarter-sawed stock, or from flat-sawed stock of slow growth. Fast-grown beech generally has high specific gravity and high shrinkage rate (4). Beech with more than 20 rings to the inch will generally shrink less than maple or oak. Fortunately, slow-grown beech is

¹UNDERLINED NUMBERS IN PARENTHESES REFER TO LITERATURE CITED, PAGE 11.

fairly common, because of the growth characteristics of the species.

Resistance To Wear

In this characteristic beech excels. Because of its close grain it does not split or splinter easily, even under heavy use. It is especially resistant to wear when wet or under water. Under friction it wears smoothly.

Its hardness makes beech suitable for floors in homes, and even more suitable for use in industrial plants and public buildings (table 2). Only hard maple is significantly better than beech for such uses as heavy-duty factory flooring and bowling alleys. It is used for such purposes by some of the best-informed buyers.

Comfort

In resilience and ability to absorb shock, beech is little if any different from the other woods more commonly used as flooring.

Attractiveness

In flat-sawed boards, beech shows a pleasing grain figure. In quarter-sawed boards it shows prominent wood rays, but they are not so striking as those of oak.

Perhaps the color of beech is one of its finer points. Although the sapwood is nearly white, the heartwood often has a soft, warm, reddish color. Flooring cut from selected red heartwood is especially attractive. Flooring of mixed red heartwood and white sapwood presents pleasing color patterns and contrasts.

Capacity For Refinishing

Even after years of neglect and heavy wear, beech flooring can be sanded and refinished to appear like new. The qualities that give it resistance to wear make this possible. Because beech is close-grained it does not have to be filled, as the oaks do, and it does not discolor and absorb dirt as readily as the more porous woods. Consequently, beech can be refinished with lighter sanding than would be needed for, say, oak.

Table 1.--How partially dry beech compares¹
with other species in shrinkage

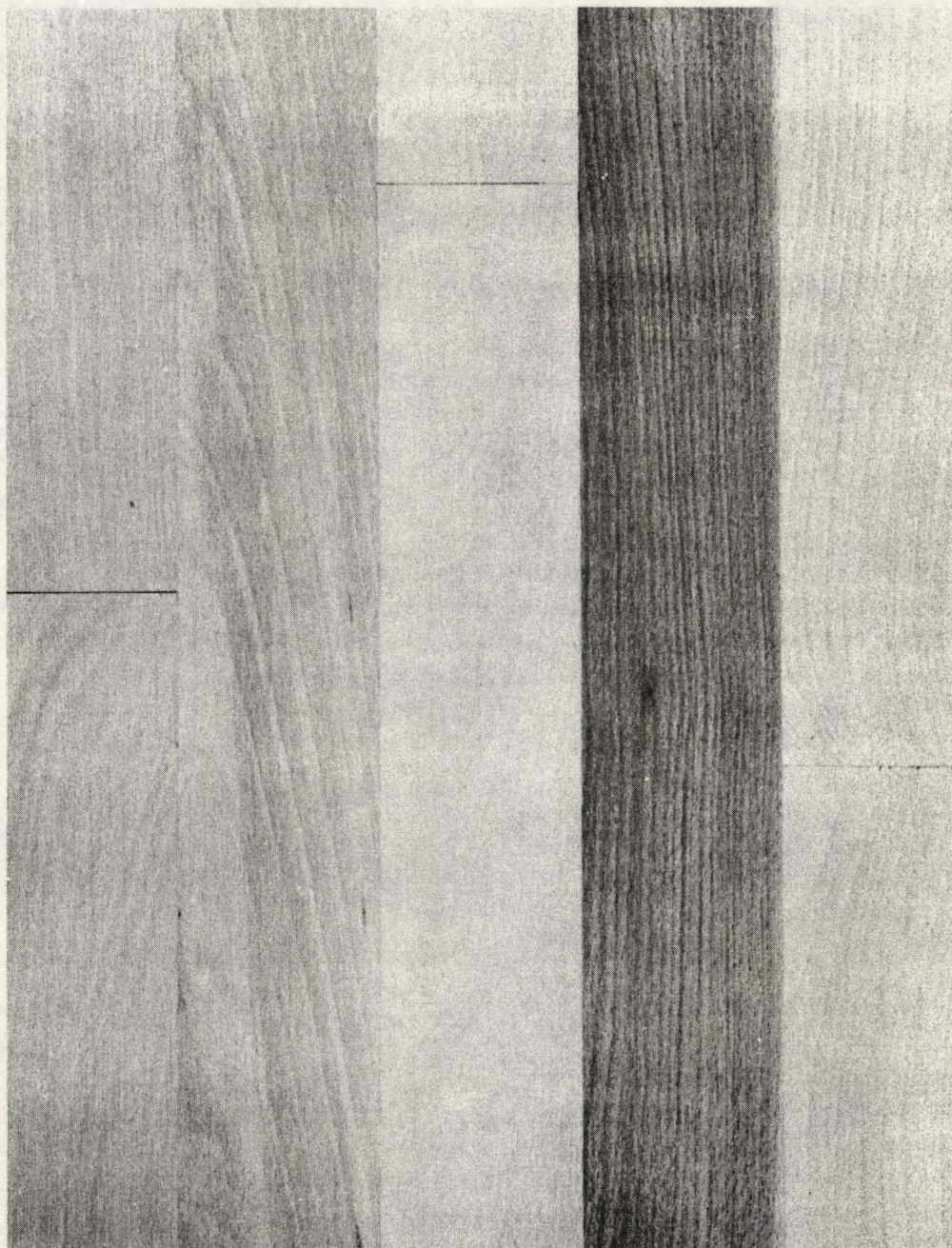
Species	Radial shrinkage	Tangential shrinkage
	<u>Percent</u>	<u>Percent</u>
Red oak	1.0	2.3
Hard maple	1.3	2.3
Beech	1.2	2.7
White oak	1.3	2.4
Yellow birch	1.8	2.3

¹Average, air-dry to kiln-dry, based on volume when air-dry (5).

Table 2.--How beech compares with other
species in hardness

Species	Load needed to embed 0.444-inch ball to 1/2 its diameter
	<u>Pounds</u>
Yellow birch	1,260
Red oak	1,290
Beech	1,300
White oak	1,360
Hard maple	1,450

Source: (3).



COURTESY MAPLE FLOORING MANUFACTURERS ASSOCIATION

Figure 1.--First-grade beech flooring. The mixed red heartwood and white sapwood of beech make attractive color contrasts possible. In structural qualities, wearing ability, and costs, beech flooring compares well with flooring made from other hardwoods such as maple and birch.

Economy

Besides these intrinsic qualities of beech wood, which assure the manufacturer that he is putting out a good product and which give him good selling points, there is the factor of economy in making flooring from beech. This is largely a question of availability.

Almost everywhere in the Northeast, beech lumber is available in quantities large enough to provide a steady flow of raw material suitable for manufacture into flooring. Even though beech has been considered an inferior wood for most purposes, in 1947, for example, it ranked fourth in hardwood lumber production in New England (8) and third in the Middle Atlantic States (9).

Beech stumpage and lumber both cost less than the other hardwood species used for flooring. Quotations for No. 2 common beech are commonly \$10 to \$18 less a thousand board feet than those for maple, oak, and birch. This should enable the manufacturer to quote a competitively lower price on his beech flooring.

MANUFACTURE OF FLOORING

Seasoning

Usually lumber purchased for manufacture into flooring is air-dried at the sawmill for a period of 4 to 7 months, and then is kiln-dried by the flooring manufacturer. Beech, especially the heartwood, is difficult to dry without excessive degrade. The rays in the wood form weak spots; they check easily in the drying process, and flat-sawed beech is apt to warp and cup.

These seasoning difficulties can be overcome. New methods and improvements in old methods make it possible to dry beech efficiently, with relatively little loss or degrade. These methods will be described in a later paper in this series.

In many cases, the flooring manufacturer will find advantage in buying his beech green from the sawmill, so that he can control the entire drying process effectively. To do this he must get the lumber immediately after it is

sawed, or make sure the freshly sawed lumber is kept under cover until it is delivered to him. Even a few hours' exposure to sunlight and drying winds in the spring and summer will result in surface- and end-checking of freshly sawed beech.

If sawmills that supply beech lumber take the proper precautions, they can air-dry this species successfully for use in flooring manufacture. In purchasing beech lumber, the flooring manufacturer might find advantage in prescribing proper air-drying precautions as part of the contract he makes with the supplier.

Careful kiln-drying is also required for beech. Kiln-drying schedules for beech can be developed from Forest Products Laboratory data (7).

Mill Processes

Beech can be fabricated into flooring with the same methods and machines used for hard maple and oak. Practically no changes in machine set-ups or processing procedures are necessary. However, in some cases greater speeds and slightly different methods of grinding knives and sharpening saws will bring about greater efficiency in the manufacture of flooring. Details about the machining of beech will be discussed in a later paper in this series.

Flooring can be manufactured with fairly simple equipment. Many sawmills already have all the equipment they would need to make flooring. The only machines needed are a gang rip saw, thickness planer, moulder and matcher, and belt sander, along with conveying and sorting devices, which can be devised. A number of Northeastern sawmills are manufacturing small quantities of flooring in this way for local markets.

Of course a mill whose primary product is flooring can operate most efficiently by using machinery and equipment specially designed for use in manufacture of flooring.

INSTALLATION OF FLOORING

The same methods and precautions used in installing other kinds of flooring apply equally well to beech flooring (2). Excellent instructions for flooring installation are

issued by the flooring manufacturers' associations, and the principles are well known to the trade.

Beech is more resistant to splitting by nails or screws than maple or birch, and is only slightly less resistant to splitting than the oaks (table 3).

Table 3.--How beech compares with other species
in splitting

Species	By nails: pieces free of complete splits	By screws: pieces free of complete splits
	<u>Percent</u>	<u>Percent</u>
Hard maple	27	52
Yellow birch	32	48
Beech	42	58
Red oak	56	78
White oak	69	74

Source: (1).

The shrinkage rate of beech, slightly higher than that of the other commonly used flooring woods--especially in the tangential direction--calls for a little extra care in handling and storing beech flooring en route to installation. Certified flooring is kiln-dried at the factory to a moisture content of 6 to 7 percent. The manufacturer should try to insure that it reaches the final installation without picking up additional moisture.

The various people who handle and store beech lumber en route to its final installation should be cautioned not to leave it exposed to the weather, and storage for any length of time should be in closed, ventilated sheds where the humidity is under control.

FINISHING

Beech takes a fine finish without filling. Beech flooring can be finished successfully with any of the methods or finishes used for other hardwoods.

Beech flooring can be pre-finished at the factory. This adds sale appeal. At the same time it protects the flooring, to some extent, from changes in moisture content between manufacture and installation.

SUMMARY

The author believes that both manufacturers and consumers penalize themselves by not using more beech flooring. Beech is generally available in the same stands and from the same sawmills that produce the more favored flooring woods: maple, birch, and oak.

Seasoning of beech presents some problems, but the remedies are known. Beech flooring can be manufactured, finished, and installed with the same equipment and methods used for other hardwood species.

Properly installed, finished, and maintained, beech flooring can be depended upon to give excellent service under the most severe conditions. Red heartwood of beech has a particularly pleasing color, and the red and white wood of this species can be mixed for special decorative effects.

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(CONTINUED FROM INSIDE OF FRONT COVER)

- * Chemistry and chemical utilization of beech.
 - Management of beech.
 - Beech availability and supply.
 - Present markets and uses for beech.
 - Methods of logging beech.
 - Seasoning of beech.
- * Storage of beech logs and bolts.
 - Machining of beech.
 - Milling of beech.
- * Gluing techniques for beech.
- * Steam-bending of beech.
 - Preservative treatment of beech.
- * Beech for flooring.
 - Beech for furniture.
 - Beech for turned products and novelties.
- * Beech for veneer and plywood.
 - Beech for fuel and charcoal.
 - Beech for cross ties.
 - Beech for containers.
 - Pulping and defiberization of beech.
 - Rough construction on the farm with beech.

The Northeastern Station acknowledges gratefully the effort being devoted to these problems by the many agencies and individuals who are cooperating in this project. Among the leaders in it are David B. Cook, New York State Conservation Department; Claude Bell, U.S. Forest Products Laboratory; A. H. Bishop, State University of New York, College of Forestry; and Fred Wangaard, Yale University School of Forestry. These men, along with Fred C. Simmons and C. R. Lockard of the Northeastern Station, comprise the "working committee" that is directing and coordinating the project.

The information gathered in this widespread cooperative project should be of great use to the wood-using industries of the regions where the wood of American beech is available.

Ralph W. Marquis

Ralph W. Marquis, Director
Northeastern Forest Experiment Station
102 Motors Avenue, Upper Darby, Pa.